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Incidence of Cardiac Rhythm Abnormalities and Ventricular Repolarisation Parameters in Hypertension Complicated by Hypertensive Crisis

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Abstract: Hypertension (HF) is the most common problem worldwide as it is the leading cause of mortality and early disability in patients [1,18,14]. According to many studies, GB affects 65 to 72 million people in the USA [8,13] and up to 1 billion people worldwide [6,15]. In the Russian Federation, the incidence of GB in 2018 was 39.5% and for the period 2019-2021 this rate was 40.4% [3, 4].

Keywords: Hypertension, hypertensive crises, diastolic left ventricular dysfunction, atrial fibrillation.

Introduction. In the last decade, there has been an increasing trend in the incidence of hypertension in Uzbekistan. Unfortunately, only 9 to 14% of patients with GB control their blood pressure and about 30% of patients with GB are unaware of their disease. Despite the wide range of diagnostic and treatment methods currently available, in most countries of the world, adequate control of the disease has not been achieved. The likelihood of developing GB increases with age [5, 20]. According to many studies in the last 10 years there is a trend towards a more severe course of GB, manifested by an increased incidence of complications, primarily hypertensive crises (HC), cerebrovascular complications such as strokes and hypertensive encephalopathy [2, 7, 19].

In recent years, the role of GB in the development of cardiac rhythm disturbances has been actively studied. The factors determining the electrophysiological remodeling of the heart and the manifestation of arrhythmias in GB include: pathogenetic mechanisms of GB, having also proarrhythmic effect, risk factors of GB, structural and functional changes of heart (left ventricular diastolic dysfunction (LVD) and left ventricular hypertrophy (LVH)), cardiac associated clinical conditions, iatrogenic medication factors [2, 6, 10]. As GB progresses, patients become prone to cardiac arrhythmias at all stages of the disease. In GLD there occurs remodeling of ion channels, leading to changes in depolarization, and there is a remodeling of gap contacts, contributing to abnormal pulse conduction [2, 3, 17, 19]. All this leads to changes on ECG and arrhythmias. In the development of atrial fibrillation (AF), the main risk factor is GB, in which structural remodelling of the left atrium (LV) occurs and is a key mechanism in the occurrence and maintenance of AF. In the presence of GB in men and women, the risk of AF increases 1:5, 1:4, respectively [4, 9]. There is some evidence that among ventricular arrhythmias, rare ventricular extrasystoles (VES), polymorphic VES, and frequent and complex ventricular arrhythmias in HF with and without HF are

more common in both men and women. Polymorphic EFH is somewhat more common in persons with HF in the presence of HF [2, 12, 22]. In isolated VSD, supraventricular arrhythmias, including paroxysmal AF, are predominantly diagnosed [3, 11, 23]. In HLV combined with VSD, ventricular arrhythmias up to and including paroxysmal ventricular tachycardia and ventricular fibrillation occur predominantly.

Thus, arterial hypertension due to a complex of pathogenetic factors, including structural and functional changes in the myocardium, contributes to the development of cardiac rhythm disturbances, which requires timely detection of these changes and adequate medication correction.

Purpose of study: To investigate the frequency of ectopic activity and the relationship of ventricular repolarisation indices in patients with hypertension (HD) complicated by hypertensive crisis.

Materials and Methods. The study involved 83 patients diagnosed with hypertension of II and III stages and hospitalized at the Emergency departments #1 and #2 of Samarkand Branch of Russian Center of EMDR. Depending on stage of hypertension patients were divided into 2 groups: the 1st group included 46 patients with II stage of hypertension and the 2nd group included 37 patients with III stage of hypertension. The blood pressure in the main group patients was 140-200 mmHg, BP was 90-120 mmHg, the average duration of disease was 8.2±3.4 years. The mean age of the patients was 52.9±2.2 years. The control group included 20 patients, comparable with the patients of the main group according to the main characteristics, whose mean age was - 68.4±2.9 years. All the patients studied underwent standard 12-channel ECG and analysis of ventricular repolarisation by conventional technique and 24-hour Holter ECG monitoring. Statistica 7.0 software package (Statsoft) was used for statistical analysis, nonparametric methods of description (as M±m) and data comparison (Mann-Whitney U-Test) were applied.

Results. Heart rhythm disturbances were detected in 39 (93,02%) AH patients and in 31 (60,0%) control patients in the main group. Ectopic ventricular and supraventricular activity was higher in group 1 patients than in group 2. The 24-hour ECG monitoring in patients with GB revealed different rhythm abnormalities (Table 1). Thus, while the frequency of single supraventricular extrasystoles was approximately the same in group 1 and group 2 patients, paired and group supraventricular extrasystoles, as well as single and paired ventricular extrasystoles were significantly more frequently detected in group 2 patients. Group ventricular extrasystoles were found only in patients with MS. There were also gender peculiarities: men with GB had higher frequency of supraventricular and ventricular extrasystoles compared to women. The mean daily number of rhythm disturbances was also higher in patients with stage III diabetes. Our studies have shown that early stages of GB are associated with rhythm disturbances: high ventricular extrasystoles, supraventricular extrasystoles, tachyarrhythmias and sinus node dysfunction [4, 21].

Table 1. Frequency of rhythm disturbances in patients with GB complicated by hypertension

	Patients with GB	
Indicator	Group 1 (n=46)	Group 2 (n=37)
Single IJEs	21 (72,41%)	15 (83,3%)
Paired IJEs	11 (37,93%)	10 (43,47%)
Grouped VAE	4 (12,5%)	10 (43,47%)
LV tachycardia	8 (27,58%)	4 (17,39%)
Single EAs	11 (37,93%)	12 (66,6%)
Paired VEs	2 (6,89%)	2 (8,7 %)
Group VEs	1 (3,44%)	-

The mean values of circadian maxima of LES and LVES were 33 (10; 125) and 14 (3; 35) in group 1, and 16 (1:31) and 13 (1:5) in group 2 ($p<0.01$). Paired VES (13.2% of the examined patients), paired VES (11.5%), and group VES (8.4%) occurred in GB patients.

Atrial fibrillation was significantly higher in group 2 patients: paroxysms of atrial fibrillation - atrial flutter - were detected in 9% of group 2 patients, and in 4% of group 1 patients. Regression analysis

showed that GB was an independent risk factor for paroxysmal atrial fibrillation-triggered fibrillation. Analysis of myocardial repolarization parameters revealed increased mean values of uncorrected and corrected QT intervals. The increase of AH degree was accompanied by increasing shift of repolarization dispersion indices: thus, the DQ-Tc value in patients with high BP (BP 180-200 mmHg, BP 10-120 mmHg) was 104.5±3.5 ms, compared with DQ-Tc values in patients with mild and moderate AH (97.0±1.8 and 104.5±2.2 ms, respectively). Direct significant correlations with DQ-T-r = 0.32 ($p<0.05$), with DQ-Tc-r = 0.37 ($p<0.05$) were found when assessing correlations of repolarization dispersion with number of high-grade ventricular arrhythmias (Laun-Wolfe III-V).

Conclusion. Patients with stage III hypertensive crises significantly more often than patients with stage II diabetes have arrhythmias of all grades, with an increase in Lown grade with increasing degree of AH. In patients with crisis-induced hypertension, ventricular repolarisation is also impaired, which is more pronounced in the severe course of the disease. These shifts reflect the inhomogeneity of ventricular repolarisation, which is associated with an increased risk of cardiac arrhythmias.

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